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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/844,679	04/30/2001	Teruichi Watanabe	Q64172	8978

7590 12/16/2003

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EXAMINER	
YAMNITZKY, MARIE ROSE	
ART UNIT	**PAPER NUMBER**
1774	

DATE MAILED: 12/16/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/844,679	WATANABE ET AL.	
	Examiner	Art Unit	
	Marie R. Yamnitzky	1774	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *14 October 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-9* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-9* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

13)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

a) ☐ The translation of the foreign language provisional application has been received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicants' amendment filed on October 14, 2003 (Paper No. 11), which amends claims 1 and 9, has been entered.

2. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

3. Claims 1-9 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claims contain subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventors, at the time the application was filed, had possession of the claimed invention.

The application as originally filed provides insufficient support for the limitations added to claims 1 and 9 regarding the luminance half-life period within a specified concentration range.

The application only discloses two devices having a concentration of iridium complex within the range set forth in present claim 1 and, of those two devices, one has a normalized half-life period of more than 4000 hours when calculated with respect to an initial luminance of 100 cd/m^2. Neither device meeting the concentration limitation of claim 1 has a non-normalized half-life meeting the limitations of claim 1.

The application only discloses two devices having a concentration of iridium complex within the range set forth in present claim 9 and, of those two devices, only one has a normalized half-life period of more than 4000 hours when calculated with respect to an initial luminance of 100 cd/m^2. Neither device meeting the concentration limitation of claim 9 has a non-normalized half-life meeting the limitations of claim 9. Further, Fig. 7 suggests that most devices having the structure set forth in the examples and having a concentration of iridium complex within the range set forth in claim 9 would not have a normalized half-life period of more than 4000 hours when calculated with respect to an initial luminance of 100 cd/m^2.

4. Claims 1-9 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for an organic electroluminescence element wherein the light emitting layer comprises a carbazole compound and 1.4 or 2.9 wt% of tris(2-phenylpyridine)iridium and the device has a normalized half-life period of more than 4000 hours when calculated with respect to an initial luminance of 100 cd/m^2, does not reasonably provide enablement for an organic electroluminescence element wherein the iridium complex compound is any iridium complex compound and the luminance half-life period is not a normalized half-life period calculated with respect to an initial luminance of 100 cd/m^2. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the invention commensurate in scope with these claims.

The only data presented in the original disclosure pertains to devices in which the iridium complex compound is tris(2-phenylpyridine)iridium. Luminance half-life periods are measured

based on the initial luminance for each device when driven with a regulated current of 2.5 mA/mm^2, and normalized half-life periods are calculated with respect to an initial luminance of 100 cd/m^2. None of the measured luminance half-life periods are more than 4000 hours, and only the devices having a tris(2-phenylpyridine)iridium concentration of 1.4 or 2.9 wt% have a calculated normalized half-life period of more than 4000 hours.

5. Claims 1-9 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The limitations imposed by the requirement that the electroluminescence element "satisfy a luminance half-life period of more than 4000 hours" are indefinite because the conditions for measuring or calculating the luminance half-life period are not set forth in the claims. Luminance half-life period can be measured or calculated in different ways resulting in different values as demonstrated by the table set forth on page 26 of the present specification, and as demonstrated by the prior art of record (e.g. see Fig. 3 in the 1999 *Jpn. J. Appl. Phys.* article by Tsutsui et al.).

The limitations imposed by the phrase "in a luminance half-life period characteristic of the organic electroluminescence element with respect to a concentration of the iridium complex compound in the light emitting layer made of the carbazole compound" as recited in claims 1 and 9 are not clear. It is not clear if/how this language further limits the requirement that the electroluminescence element "satisfy a luminance half-life period of more than 4000 hours".

6. Claim 9 is rejected under 35 U.S.C. 102(b) as anticipated by Baldo et al. in *Appl. Phys. Lett.* 75(1), pp. 4-6 (July 5, 1999).

See the whole reference.

Baldo et al. disclose an electroluminescent device comprising an anode, a layer of 4,4'-bis[N-(1-naphthyl)-N-phenylamino]biphenyl (abbreviated α-NPD), a light emitting layer comprising *fac* tris(2-phenylpyridine) iridium (abbreviated $Ir(ppy)_3$) and 4,4'-N,N'-dicarbazole-biphenyl (abbreviated CBP) wherein the concentration of $Ir(ppy)_3$ is 6% by weight, a hole blocking layer of 2,9-dimethyl-4,7-diphenyl-1,10-phenanthroline (abbreviated (BCP), an electron transporting layer of tris(8-hydroxyquinoline) aluminum (abbreviated Alq_3), and a cathode.

Baldo et al. do not disclose the luminance half-life period of the device. It is the examiner's position that it is reasonable to expect that Baldo's device having 6% $Ir(ppy)_3$ in the carbazole compound CBP is capable of exhibiting a luminance half-life period of greater than 4000 hours when measured at a relatively low luminance. The present claims do not specify the conditions under which the device must satisfy a luminance half-life period of more than 4000 hours. Fig. 3 of Baldo's article shows that the device having 6% $Ir(ppy)_3$ in CBP is capable of exhibiting a luminance in the range of about 0.2 cd/m^2 at a voltage of about 3V to about 100,000 cd/m^2 at a voltage of about 11V. It is reasonable to expect that when operating the device to maintain a luminance at the lower end of the luminance range, the device will last longer than when operating the device to maintain a luminance at the higher end of the luminance range.

7. Claims 1-3 and 7-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Baldo et al. in *Appl. Phys. Lett.* 75(1), pp. 4-6 (July 5, 1999) in view of Tsutsui et al. in *Jpn. J. Appl. Phys.* 38, pp. L1502-L1504 (December 15, 1999).

See the whole Baldo article.

Baldo et al. disclose an electroluminescent device comprising an anode, a layer of 4,4'-bis[N-(1-naphthyl)-N-phenylamino]biphenyl (abbreviated α-NPD), a light emitting layer comprising *fac* tris(2-phenylpyridine) iridium (abbreviated $Ir(ppy)_3$) and 4,4'-N,N'-dicarbazole-biphenyl (abbreviated CBP) wherein the concentration of $Ir(ppy)_3$ is 1% by weight, a hole blocking layer of 2,9-dimethyl-4,7-diphenyl-1,10-phenanthroline (abbreviated (BCP), an electron transporting layer of tris(8-hydroxyquinoline) aluminum (abbreviated Alq_3), and a cathode. Baldo et al. also disclose an electroluminescent device having the same layer structure wherein the concentration of $Ir(ppy)_3$ is 6% by weight.

$Ir(ppy)_3$ is the specific iridium complex compound required by claim 2.

CBP is the specific carbazole compound required by claim 3.

The layer of α-NPD in the Baldo's devices meets the limitation of a hole injecting layer as recited in claims 1 and 9.

The ionization potential relationship required by claim 8 is inherent in Baldo's devices which comprise a hole blocking layer. It is the examiner's understanding that CBP has at least a slight ability to transport electrons and therefore considers CBP to meet the limitations of an electron transport material for purposes of claim 8.

Baldo et al. do not disclose the luminance half-life period of the devices. Baldo's device having 1% $Ir(ppy)_3$ in the carbazole compound has a concentration of iridium complex compound that is very close to the lower end of the range set forth in present independent claim 1 which requires a minimum of "more than 1 wt%". Baldo's device having 6% $Ir(ppy)_3$ in the carbazole compound has a concentration of iridium complex compound that is at the upper limit of the range set forth in present independent claim 9.

One of ordinary skill in the art at the time of the invention, having knowledge of the teachings of Tsutsui et al., would have recognized that half-life values are dependent upon factors such as the initial luminance. Fig. 3 of Tsutsui's article shows that for a single device, the lower the initial luminance used for determining half-life, the longer the half-life.

It is the examiner's position that it is reasonable to expect that Baldo's device having 6% $Ir(ppy)_3$ in the carbazole compound CBP is capable of exhibiting a luminance half-life period of greater than 4000 hours at least when measured at a relatively low luminance. The present claims do not specify the conditions under which the device must satisfy a luminance half-life period of more than 4000 hours. Fig. 3 of Baldo's article shows that the device having 6% $Ir(ppy)_3$ in CBP is capable of exhibiting a luminance in the range of about 0.2 cd/m^2 at a voltage of about 3V to about 100,000 cd/m^2 at a voltage of about 11V. It is reasonable to expect that when operating the device to maintain a luminance at the lower end of the luminance range, the device will last longer than when operating the device to maintain a luminance at the higher end of the luminance range. Devices of the same structure having slightly less than 6% $Ir(ppy)_3$ also would have been *prima facie* obvious to one of ordinary skill in the art at the time of the

invention because one skilled in the art at the time of the invention would have expected such devices to have properties very similar to the properties of the device having 6% $Ir(ppy)_3$.

It is also reasonable to expect that Baldo's device having 1% $Ir(ppy)_3$ in the carbazole compound CBP is capable of exhibiting a luminance half-life period of greater than 4000 hours when measured at a relatively low luminance. (The curve drawn to fit the data points set forth in Fig. 7 of the present application shows $L_0 = 100$ half-life to be about 4000 hours for an $Ir(ppy)_3$ concentration of 1%.) Devices of the same structure having slightly greater than 1% $Ir(ppy)_3$ would have been *prima facie* obvious to one of ordinary skill in the art at the time of the invention because one skilled in the art at the time of the invention would have expected such devices to have properties very similar to the properties of the device having 1% $Ir(ppy)_3$.

Tsutsui et al. also suggest that device structure can be optimized to increase device durability. For example, see the first full paragraph on page L1503 of Tsutsui's article. One of ordinary skill in the art at the time of the invention would have been motivated to optimize Baldo's devices in order to optimize device characteristics such as half-life. One of ordinary skill in the art at the time of the invention would have been motivated to optimize the device structure in order to optimize half-life because half-life affects the useful life of a device.

8. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Baldo et al. in view of Tsutsui et al. as applied to claims 1-3 and 7-9 above, and further in view of JP 2000-21572.

Neither the Baldo article nor the Tsutsui article discloses a device in which the carbazole compound in the light emitting layer is the carbazole compound required by claim 4. Both of these prior art references utilize the carbazole compound required by claim 3.

JP 2000-21572 discloses the carbazole compound required by claim 4 and the carbazole compound required by claim 3, and teaches that these compounds can be used in a light emitting layer of an electroluminescent device. See the abstract and see the compounds of formulae (1) and (23) (pages 7-8 of the Japanese language document).

It would have been *prima facie* obvious to one of ordinary skill in the art at the time of the invention to use other known carbazole compounds in the light emitting layer of Baldo's device. One of ordinary skill in the art would have been motivated to use other known carbazole compounds in order to provide other functional light emitting devices and, having knowledge of JP 2000-21572, would have reasonably expected that the carbazole compound required by claim 4 could be used for the same purposes as the carbazole compound of claim 3.

9. Claims 5 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Baldo et al. in view of Tsutsui et al. as applied to claims 1-3 and 7-9 above, and further in view of Mori et al. (US 5,281,489) or applicants' admitted prior art.

Neither the Baldo article nor the Tsutsui article discloses a device comprising separate hole injecting and hole transporting layers between the anode and the light emitting layer.

Baldo et al. do not disclose separate electron injecting and electron transporting layers between the cathode and the light emitting layer. Tsutsui et al. disclose a device which meets the

limitations of the layered structure: light emitting layer, electron transporting layer, electron injecting layer, cathode although Tsutsui et al. consider the electron injecting layer to be part of a bilayered cathode.

The use of multiple layers having the functions of hole injecting and/or transporting, and the use of multiple layers having the functions of electron injecting and/or transporting is known in the art as demonstrated by the patent to Mori et al. (e.g. see column 28, line 63 - c. 29, l. 49) and as admitted by applicants (e.g. see the first paragraph in the description of the related art on page 1 of the present specification).

It would have been an obvious modification to one of ordinary skill in the art to modify Baldo's device to include additional functional layers such as hole transporting and/or injecting layers or electron transporting and/or injecting layers which are known to be useful in electroluminescent devices as demonstrated by Mori et al. and as admitted by applicants. It would have been *prima facie* obvious to one of ordinary skill in the art to include additional functional layers in Baldo's device for the purposes for which these functional layers are conventionally provided.

10. Claims 1-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hosokawa (US 2002/0045061 A1).

(As noted in Paper No. 5: The cover sheet of this published application incorrectly indicates that Hosokawa's application was filed July 17, 2001. The application was actually filed March 26, 2001 and is thus available as prior art under 35 U.S.C. 102(e). Applicant cannot

rely upon the foreign priority papers to overcome this rejection because a translation of said papers has not been made of record in accordance with 37 CFR 1.55. See MPEP § 201.15.)

Hosokawa discloses electroluminescent devices in which the light emitting layer comprises a carbazole derivative and a phosphorescent dopant. Iridium complexes such as tris(2-phenylpyridine)iridium are among the more preferred phosphorescent dopants. For example, see the abstract and paragraph [0088].

The carbazole derivative required by present claim 3 is utilized in Comparative Example 1 in combination with tris(2-phenylpyridine)iridium.

The carbazole derivative required by present claim 4 is disclosed for use in Hosokawa's device (see formula (42) on page 11).

Hosokawa does not disclose any specific examples of devices meeting the present claim limitations regarding concentration of iridium complex compound and luminance half-life period. In Hosokawa's examples and comparative example, the light emitting layer comprises 7% by weight iridium complex with the remainder of the layer being the carbazole compound. However, Hosokawa teaches that the amount of phosphorescent dopant is preferably 0.1 to 30 parts by weight per 100 parts by weight of carbazole host material, more preferably 0.5 to 20 parts by weight and still more preferably 1 to 15 parts by weight. For example, see paragraphs [0094]-[0096] and claim 9 of Hosokawa's published application. It would have been within the level of ordinary skill of a worker in the art at the time of the invention to determine suitable and optimum amounts of specific iridium complexes and carbazole derivatives to be used in combination in the light emitting layer.

With respect to the luminance half-life limitation of the present claims, Hosokawa's examples demonstrate that the half-life of a device is influenced by the specific carbazole derivative. Hosokawa also demonstrates that the half-life of the device is also influenced by other structural features of the device. For example, Hosokawa demonstrates that half-life can be increased by modifying the hole barrier layer of the device. Compare Hosokawa's Examples 1, 2 and 3. Also see paragraphs [0104]-[0112].

Hosokawa's device examples include devices having a half-life of as long as 800 hours. Hosokawa measures half-life at an initial luminance of 500 cd/m^2. It is reasonable to expect that the half-life values would be greater if determined at lower initial luminance values. Hosokawa desires to increase the practical life span of an electroluminescent device. For example, see paragraphs [0018]-[0025]. It would have been *prima facie* obvious to one of ordinary skill in the art at the time of the invention to optimize device structure in order to optimize the life span of the device.

11. Applicants' arguments filed October 14, 2003 have been fully considered but they are not persuasive.

Applicants argue that the concentration ranges recited in the amended claims render the claims novel and unobvious over the cited art. The examiner respectfully disagrees. In the case of the concentration range set forth in claim 1, Baldo discloses a concentration very close to the recited range and Hosokawa discloses ranges encompassing the recited range. In the case of the

concentration range set forth in claim 9, Baldo discloses a concentration within the recited range and Hosokawa discloses ranges encompassing the recited range.

With respect to the luminance half-life period, the prior art of record demonstrates that the conditions under which the half-life is determined affect the absolute value of the half-life. The prior art of record also demonstrates that half-life is a characteristic that can be optimized.

12. Any inquiry concerning this communication should be directed to Marie R. Yamnitzky at telephone number (703) 308-4413. (On or about December 30, 2003, the examiner's telephone number will be changed to (571) 272-1531.) The examiner works a flexible schedule but can generally be reached at this number from 6:30 a.m. to 4:00 p.m. Monday, Tuesday, Thursday and Friday, and every other Wednesday from 6:30 a.m. to 3:00 p.m.

The current fax number for Art Unit 1774 is (703) 872-9306 for all official faxes. (Unofficial faxes to be sent directly to examiner Yamnitzky can be sent to (703) 872-9041. On or about December 30, 2003, the examiner's fax number for unofficial faxes will be changed to (571) 273-1531.)

MRY
December 15, 2003

Marie R. Yamnitzky

MARIE YAMNITZKY
PRIMARY EXAMINER

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